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H04L 29/06

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H4K KTKX

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WO 98/30060 A1 WO 98/23054 A1 WO 96/21983 A1
US 5978386 A US 5430727 A

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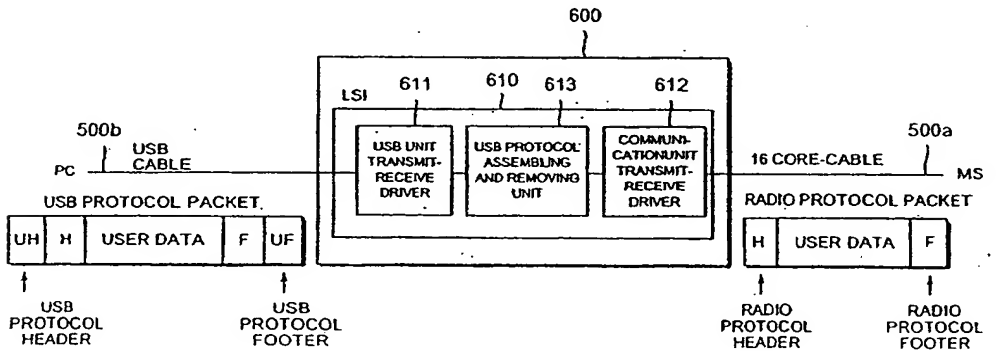
(54) Abstract Title
Protocol conversion apparatus

(57) A protocol conversion apparatus 600 allows packet data transfer between two apparatuses such as a personal computer (PC) and a mobile telephone which use different protocols, for example a USB protocol and a radio protocol respectively. The PC transmits a radio protocol packet encapsulated in a USB protocol packet. The protocol conversion apparatus decapsulates the radio protocol packet and forwards it to the mobile phone. Radio protocol packets received from the mobile telephone are encapsulated and forwarded to the PC. The PC may select one of a plurality of radio protocols for encapsulation in a USB protocol packet. A packet designating the selected protocol is sent to the apparatus 600. Radio packets above a threshold size may be segmented and individually encapsulated for transfer to and from the PC. The apparatus may be situated inside the personal computer or as a separate unit.

Fig. 7



GB 2 355 375 A

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Fig. 1

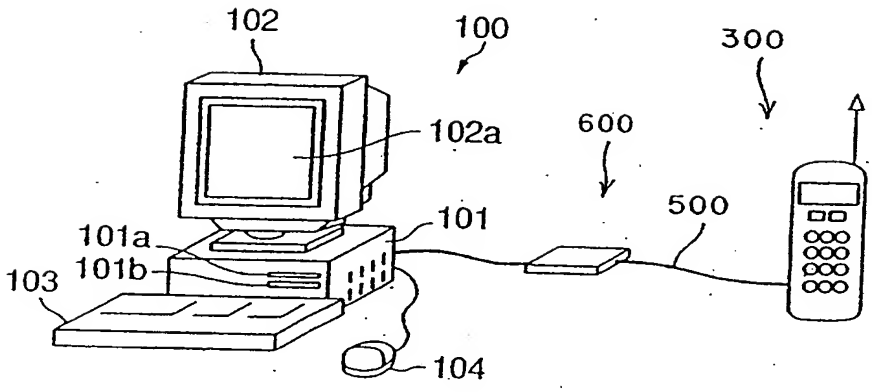


Fig. 2

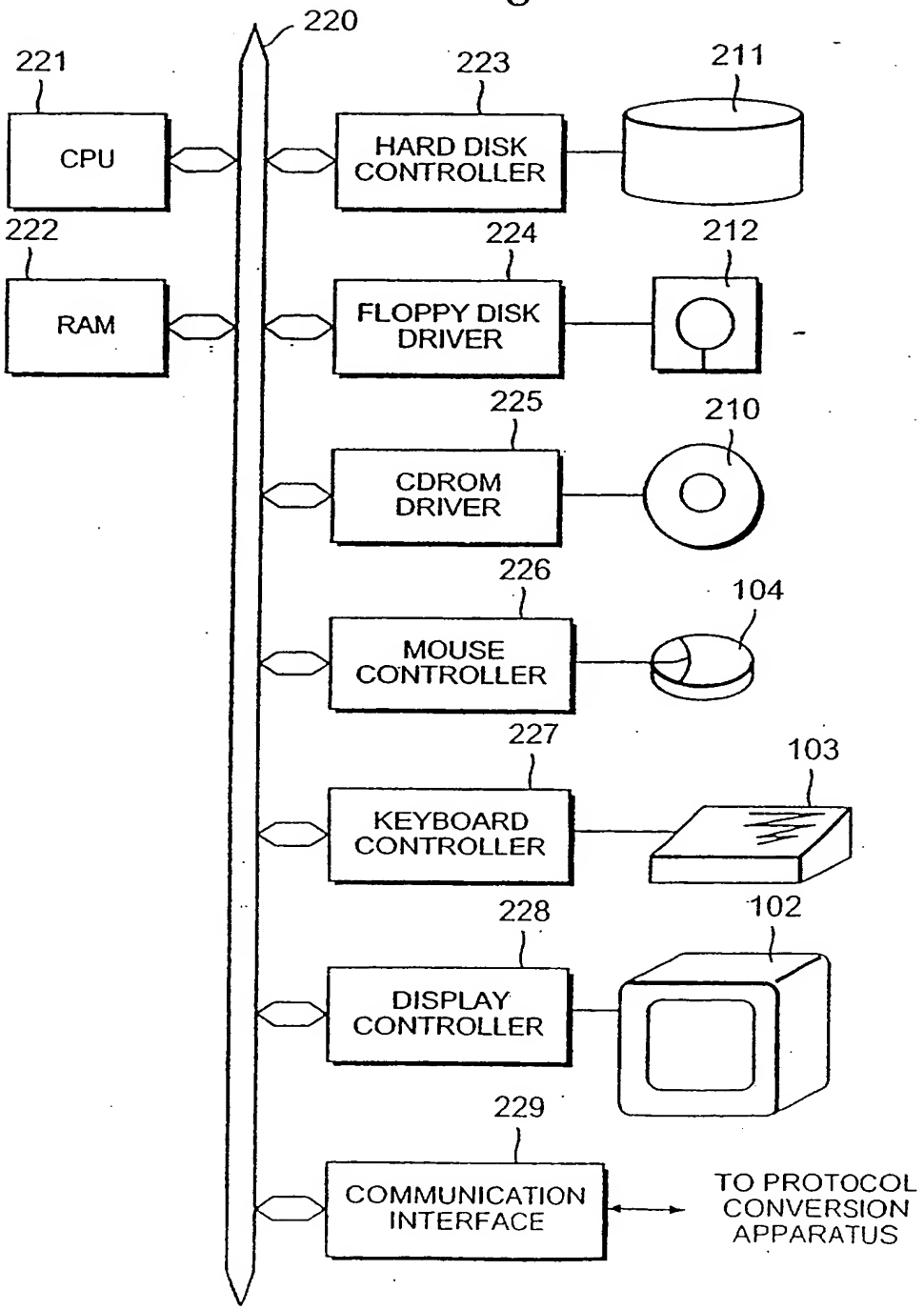

220
221
CPU
222
RAM
223
HARD DISK CONTROLLER
224
FLOPPY DISK DRIVER
225
CDROM DRIVER
226
MOUSE CONTROLLER
227
KEYBOARD CONTROLLER
228
DISPLAY CONTROLLER
229
COMMUNICATION INTERFACE
211
212
210
104
103
102
TO PROTOCOL CONVERSION APPARATUS

Fig. 3

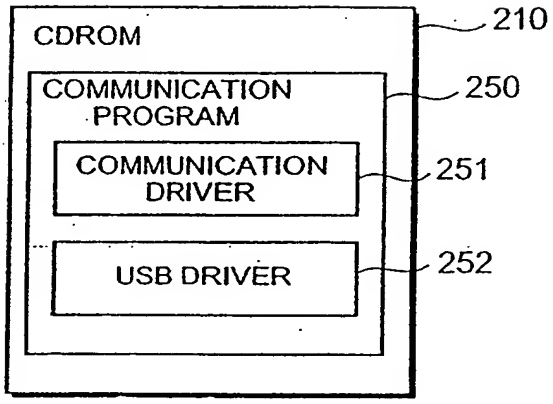

CDROM
210
COMMUNICATION PROGRAM
250
COMMUNICATION DRIVER
251
USB DRIVER
252

Fig.4

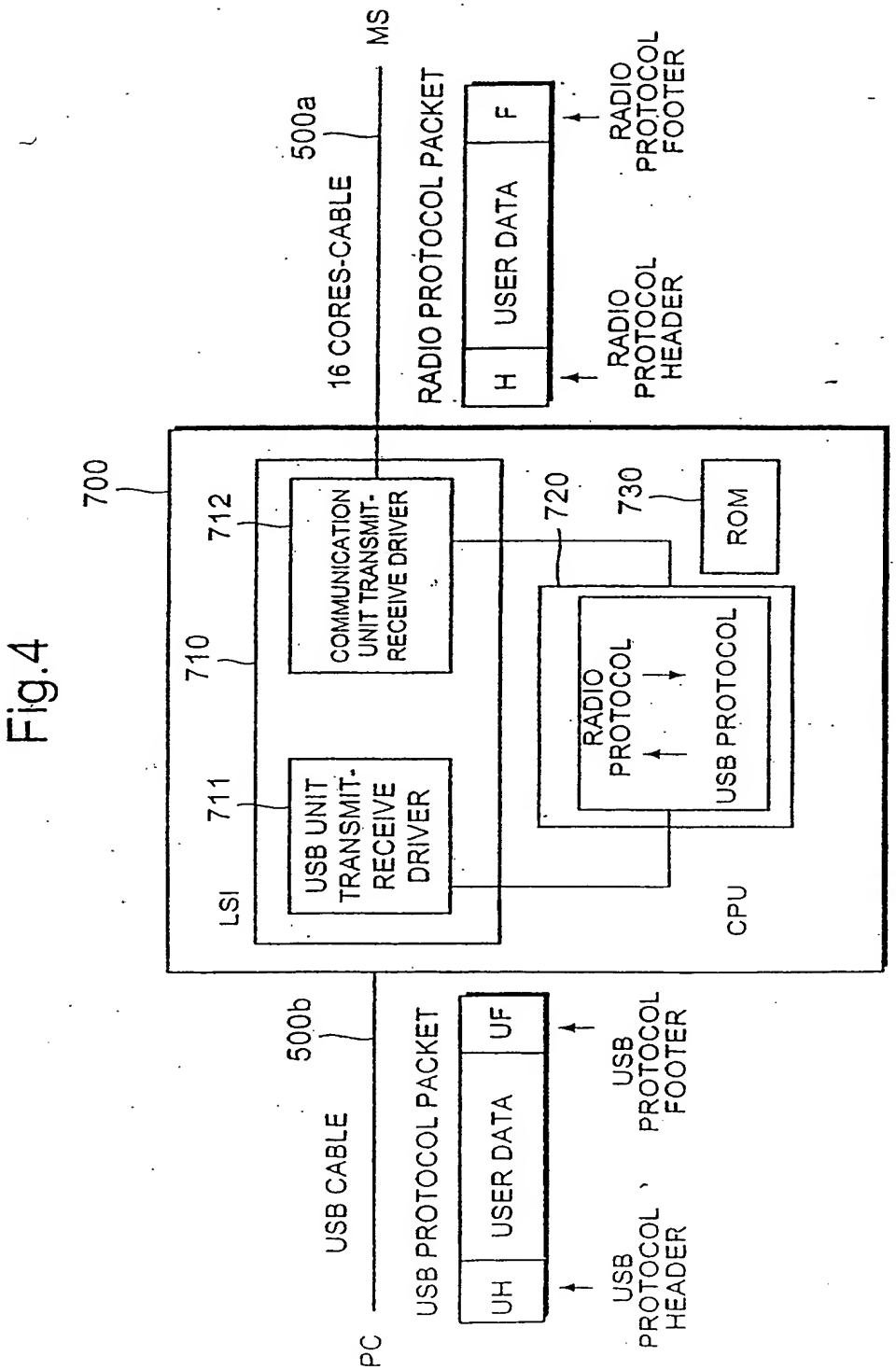

MS
500a
16 CORES-CABLE
RADIO PROTOCOL PACKET
H
USER DATA
F
RADIO PROTOCOL HEADER
RADIO PROTOCOL FOOTER
700
710
712
COMMUNICATION UNIT TRANSMIT-RECEIVE DRIVER
720
730
ROM
LSI
711
USB UNIT TRANSMIT-RECEIVE DRIVER
RADIO PROTOCOL
USB PROTOCOL
CPU
500b
USB CABLE
USB PROTOCOL PACKET
UH
USER DATA
UF
USB PROTOCOL HEADER
USB PROTOCOL FOOTER
PC

Fig. 5

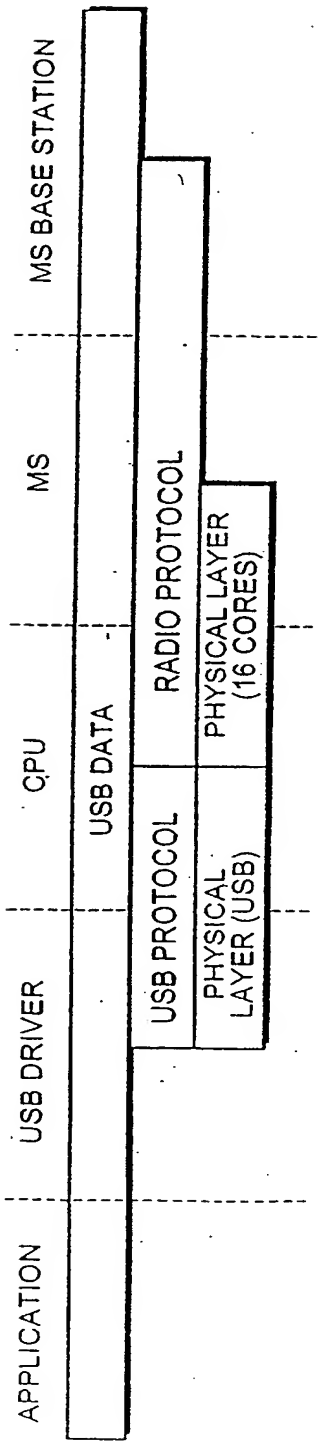

APPLICATION
USB DRIVER
CPU
MS
MS BASE STATION
USB DATA
USB PROTOCOL
PHYSICAL LAYER (USB)
RADIO PROTOCOL
PHYSICAL LAYER (16 CORES)

Fig. 6 (A)

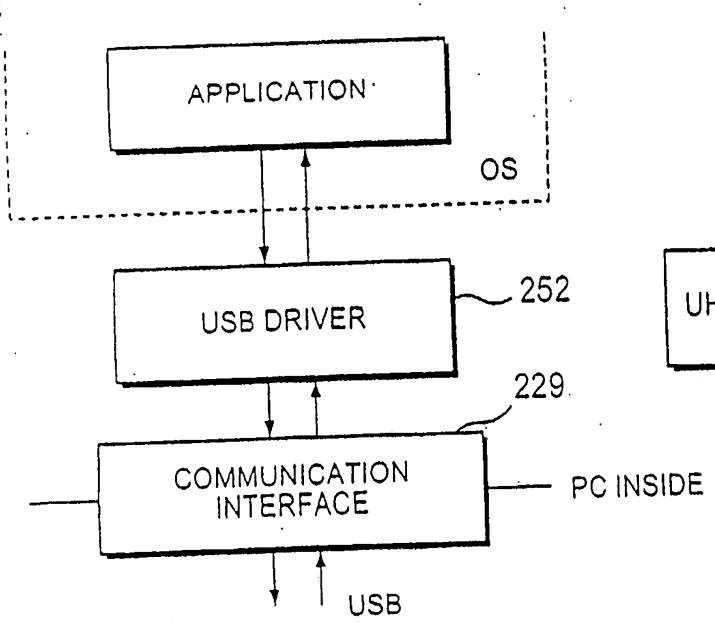
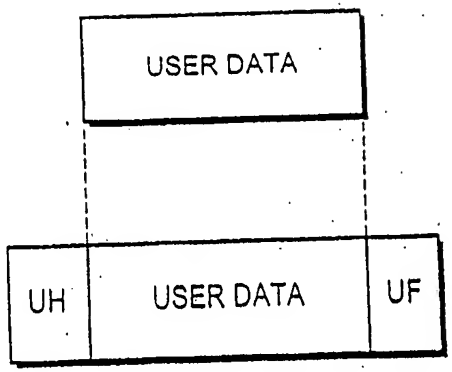


Fig. 6 (B)



UH:USB PROTOCOL HEADER

UF:USB PROTOCOL FOOTER

Fig. 7

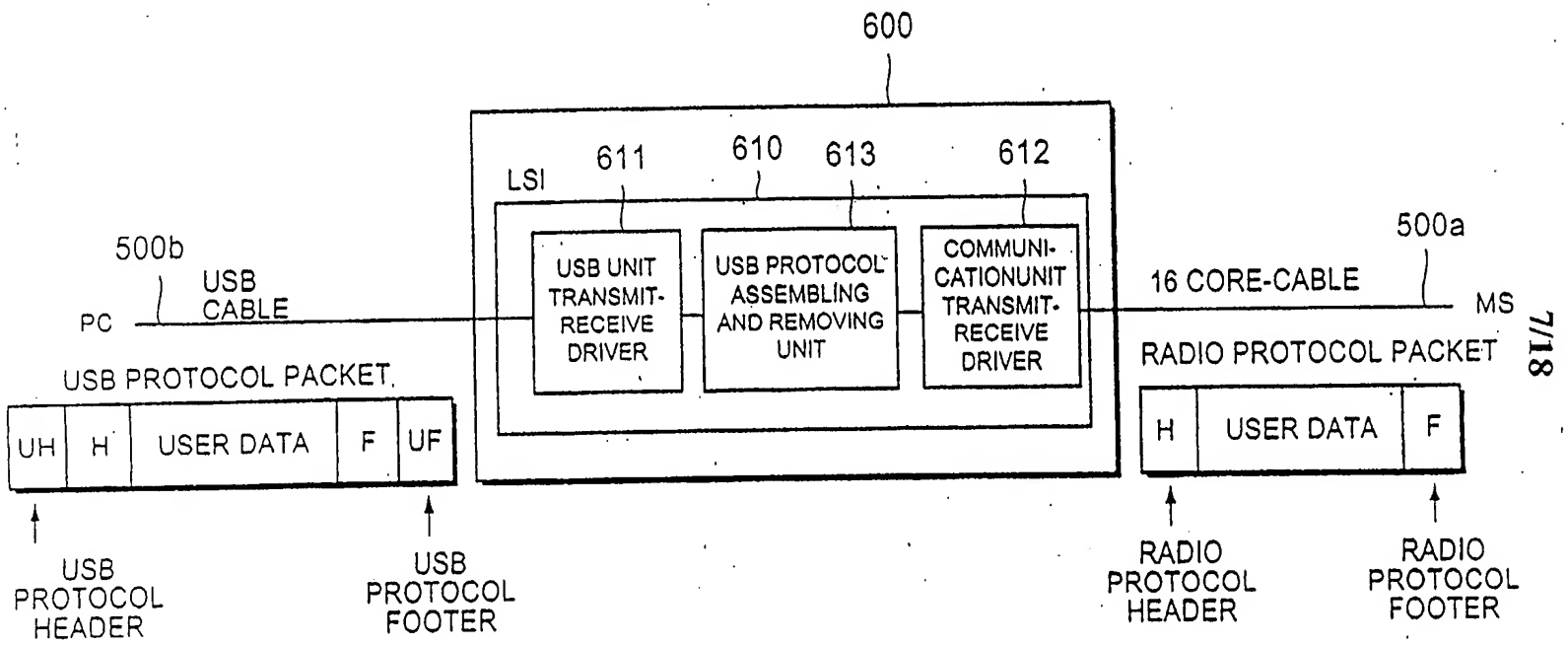

600
LSI
611
610
613
612
500b
USB CABLE
PC
USB UNIT TRANSMIT-RECEIVE DRIVER
USB PROTOCOL ASSEMBLING AND REMOVING UNIT
COMMUNI-CATIONUNIT TRANSMIT-RECEIVE DRIVER
500a
16 CORE-CABLE
MS
USB PROTOCOL PACKET
UH
H
USER DATA
F
UF
RADIO PROTOCOL PACKET
H
USER DATA
F
USB PROTOCOL HEADER
USB PROTOCOL FOOTER
RADIO PROTOCOL HEADER
RADIO PROTOCOL FOOTER

Fig. 8

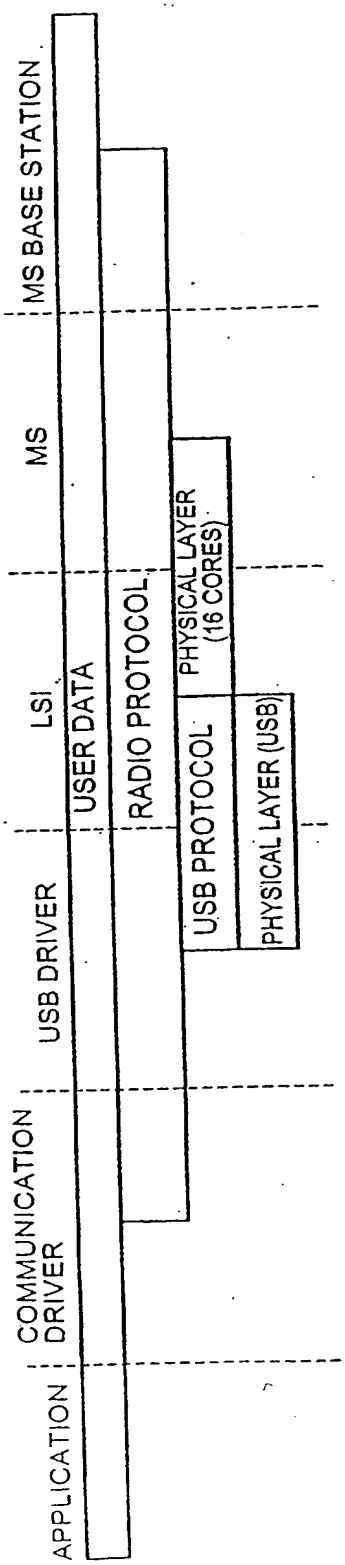

APPLICATION
COMMUNICATION DRIVER
USB DRIVER
LSI
MS
MS BASE STATION
USER DATA
RADIO PROTOCOL
USB PROTOCOL
PHYSICAL LAYER (16 CORES)
PHYSICAL LAYER (USB)

Fig. 9 (A)

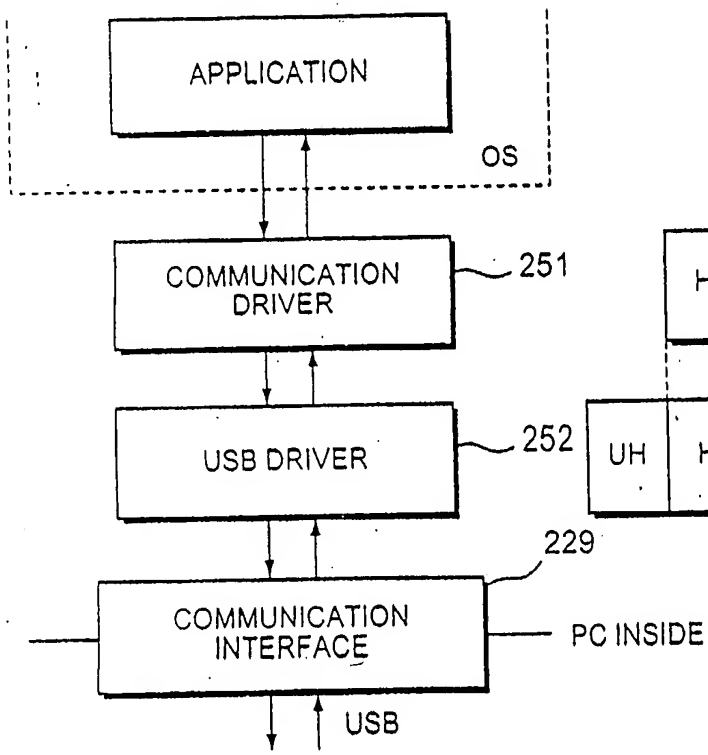

APPLICATION
OS
COMMUNICATION DRIVER
251
USB DRIVER
252
229
COMMUNICATION INTERFACE
PC INSIDE
USB

Fig. 9 (B)

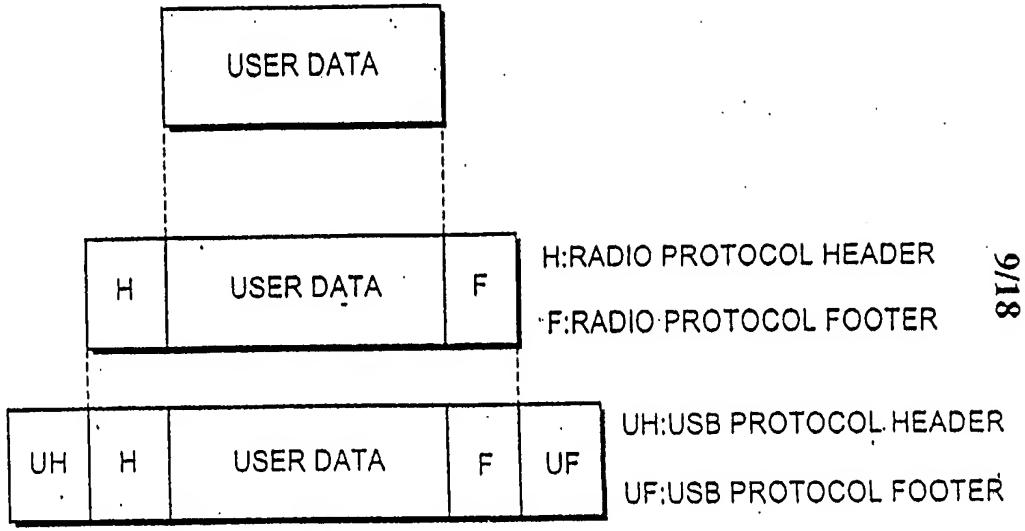

USER DATA
H
USER DATA
F
H:RADIO PROTOCOL HEADER
F:RADIO PROTOCOL FOOTER
UH
H
USER DATA
F
UF
UH:USB PROTOCOL HEADER
UF:USB PROTOCOL FOOTER

Fig.10

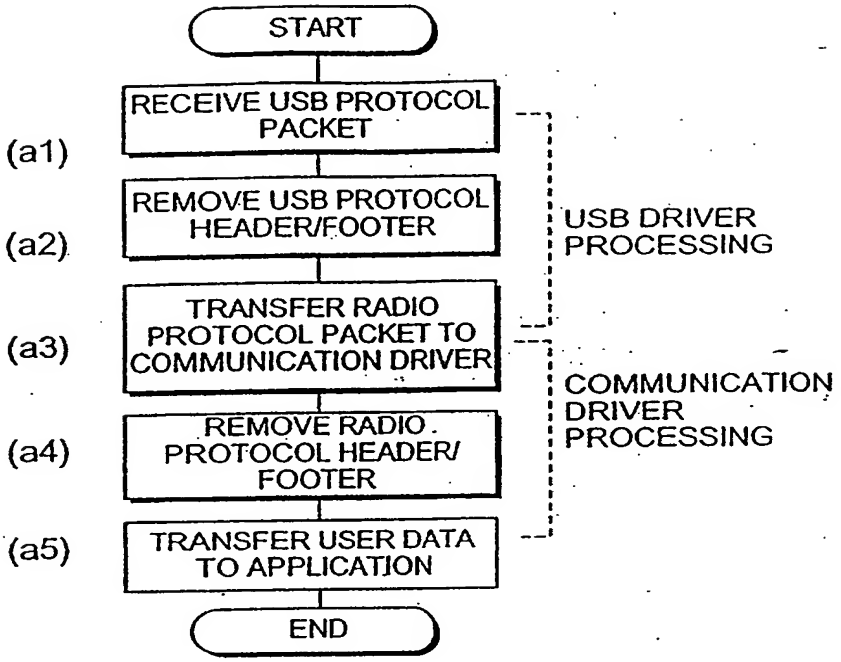

START
RECEIVE USB PROTOCOL PACKET
(a1)
REMOVE USB PROTOCOL HEADER/FOOTER
(a2)
TRANSFER RADIO PROTOCOL PACKET TO COMMUNICATION DRIVER
(a3)
REMOVE RADIO PROTOCOL HEADER/ FOOTER
(a4)
TRANSFER USER DATA TO APPLICATION
(a5)
END
USB DRIVER PROCESSING
COMMUNICATION DRIVER PROCESSING

Fig.11

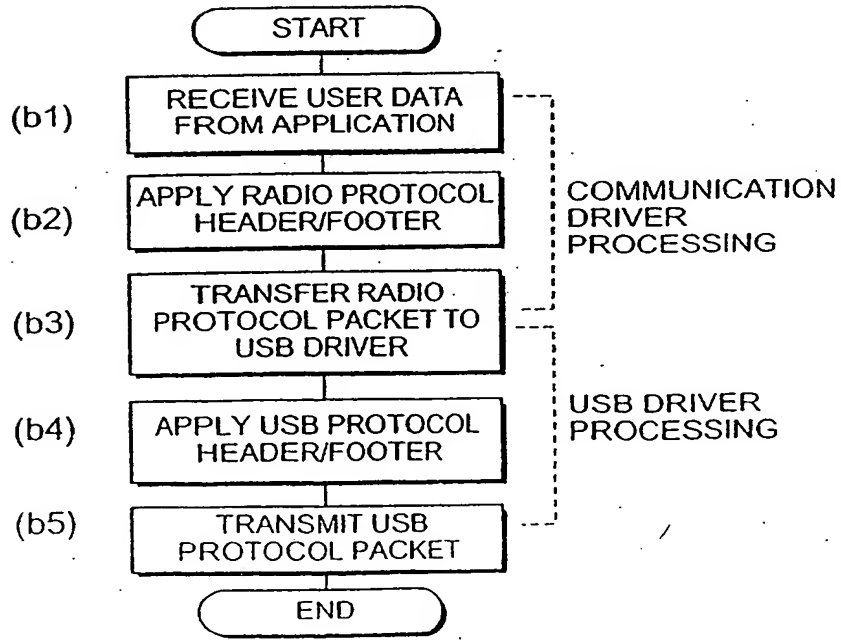

START
RECEIVE USER DATA FROM APPLICATION
(b1)
APPLY RADIO PROTOCOL HEADER/FOOTER
(b2)
TRANSFER RADIO PROTOCOL PACKET TO USB DRIVER
(b3)
APPLY USB PROTOCOL HEADER/FOOTER
(b4)
TRANSMIT USB PROTOCOL PACKET
(b5)
END
COMMUNICATION DRIVER PROCESSING
USB DRIVER PROCESSING

Fig. 12

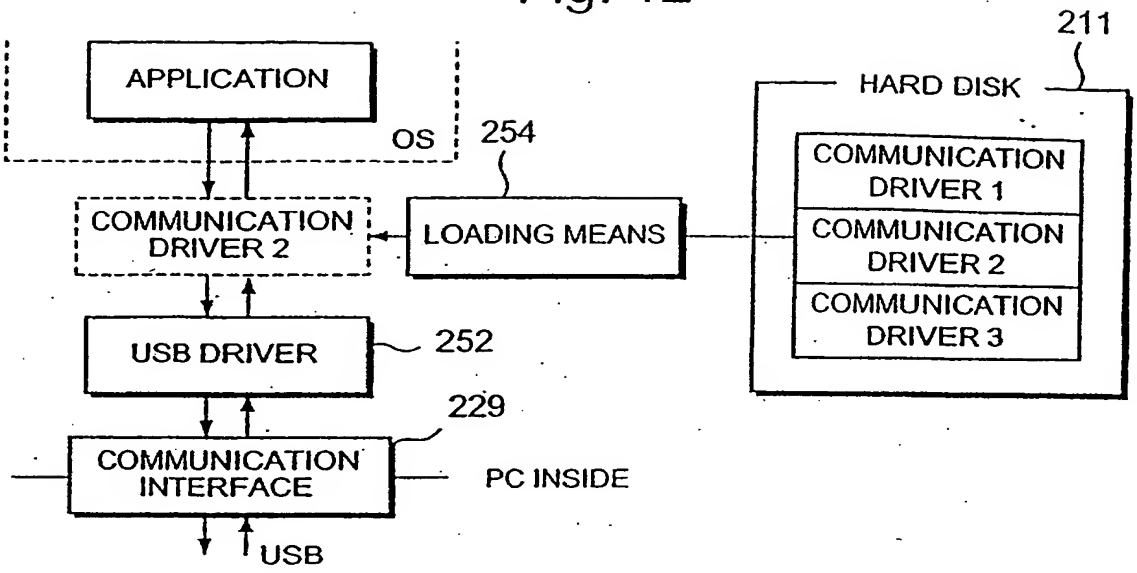


Fig. 13

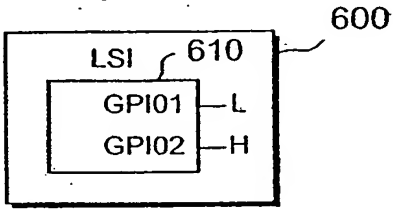


Fig. 14

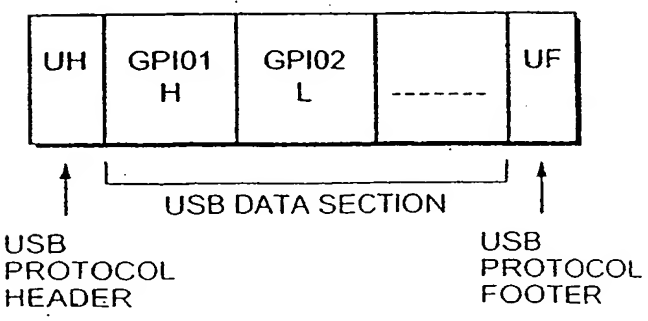
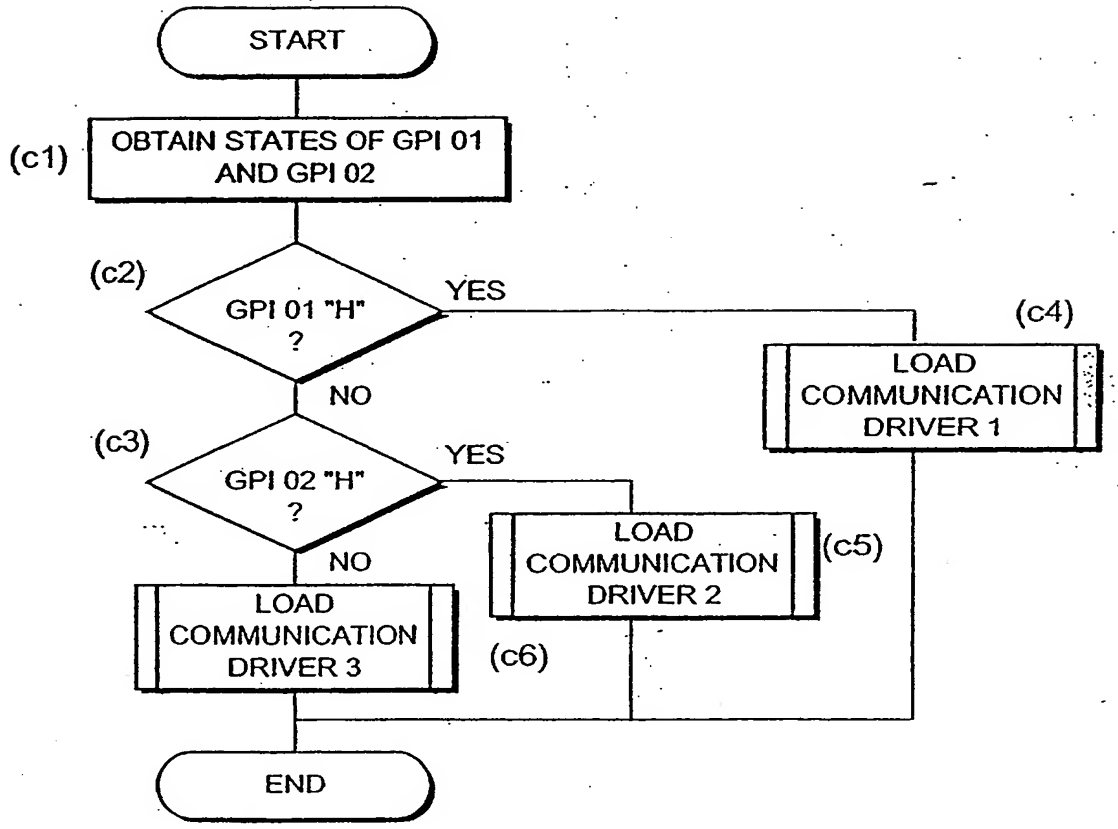


Fig. 15


START
(c1)
OBTAIN STATES OF GPI 01 AND GPI 02
(c2)
GPI 01 "H" ?
YES
(c4)
LOAD COMMUNICATION DRIVER 1
NO
(c3)
GPI 02 "H" ?
YES
LOAD COMMUNICATION DRIVER 2
(c5)
NO
LOAD COMMUNICATION DRIVER 3
(c6)
END

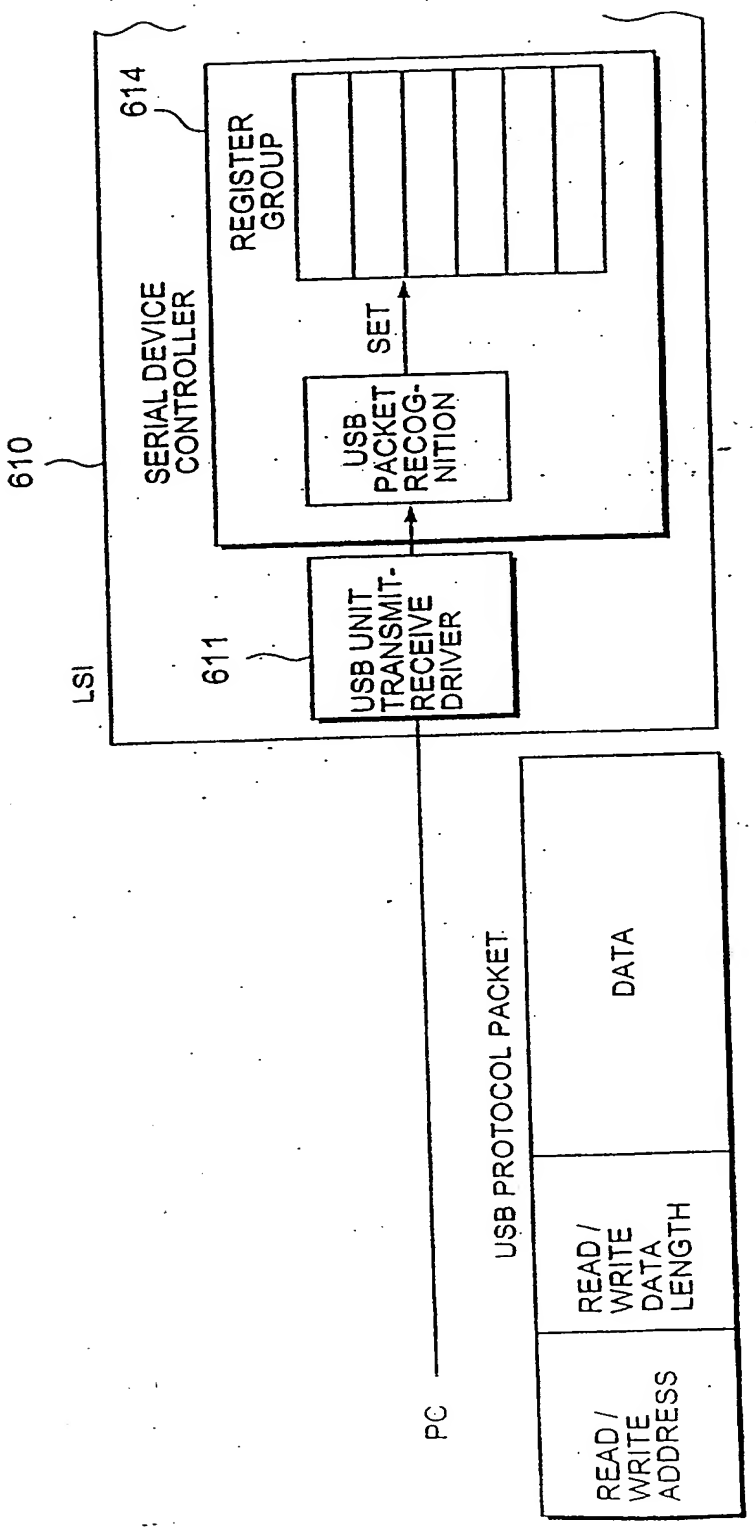

LSI
610
SERIAL DEVICE CONTROLLER
614
REGISTER GROUP
SET
USB PACKET RECOG-NITION
611
USB UNIT TRANSMIT-RECEIVE DRIVER
PC
USB PROTOCOL PACKET
READ / WRITE ADDRESS
READ / WRITE DATA LENGTH
DATA

Fig. 16

Fig.17

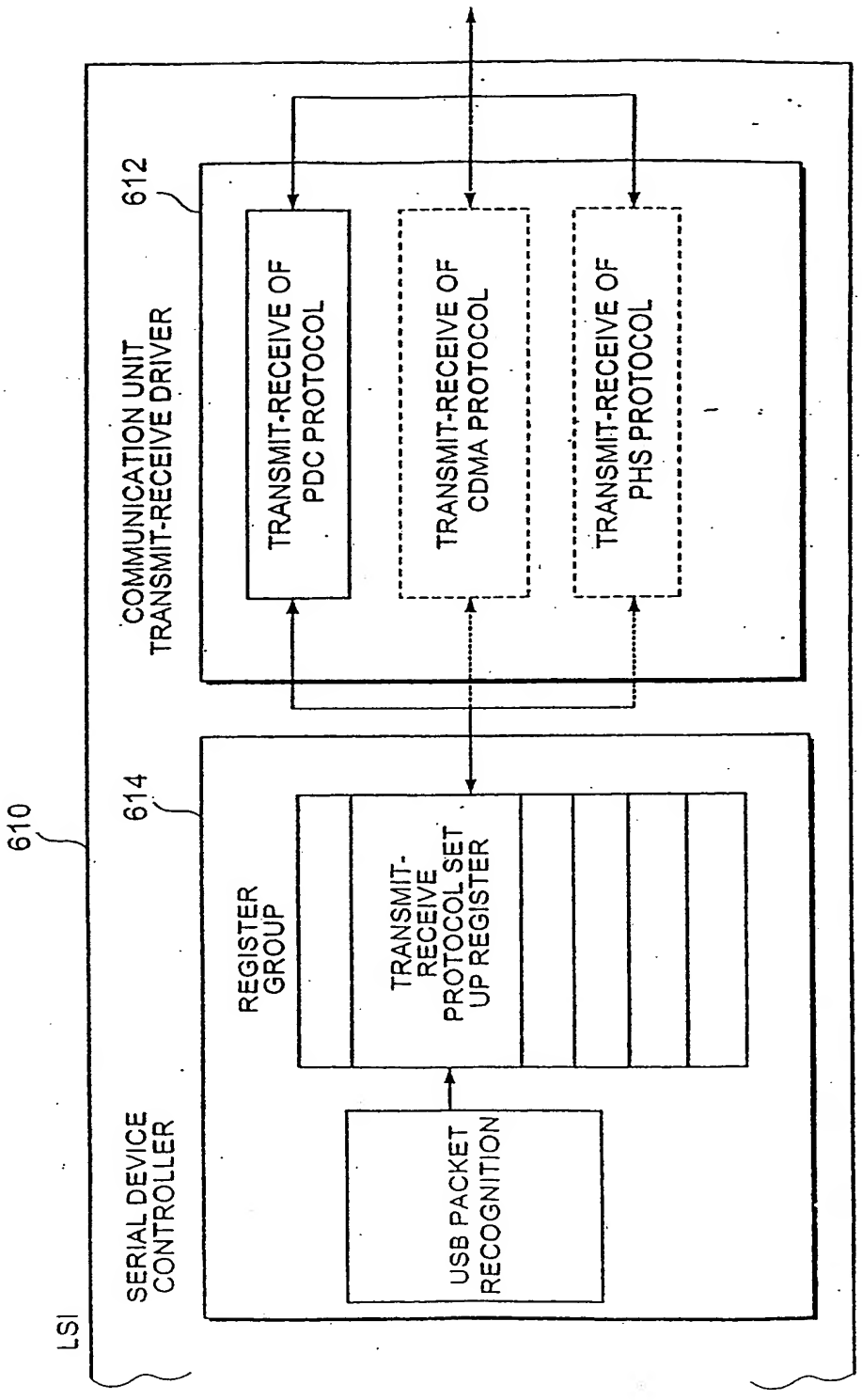

LSI
610
SERIAL DEVICE CONTROLLER
614
REGISTER GROUP
TRANSMIT-RECEIVE PROTOCOL SET UP REGISTER
USB PACKET RECOGNITION
COMMUNICATION UNIT TRANSMIT-RECEIVE DRIVER
612
TRANSMIT-RECEIVE OF PDC PROTOCOL
TRANSMIT-RECEIVE OF CDMA PROTOCOL
TRANSMIT-RECEIVE OF PHS PROTOCOL

Fig.18

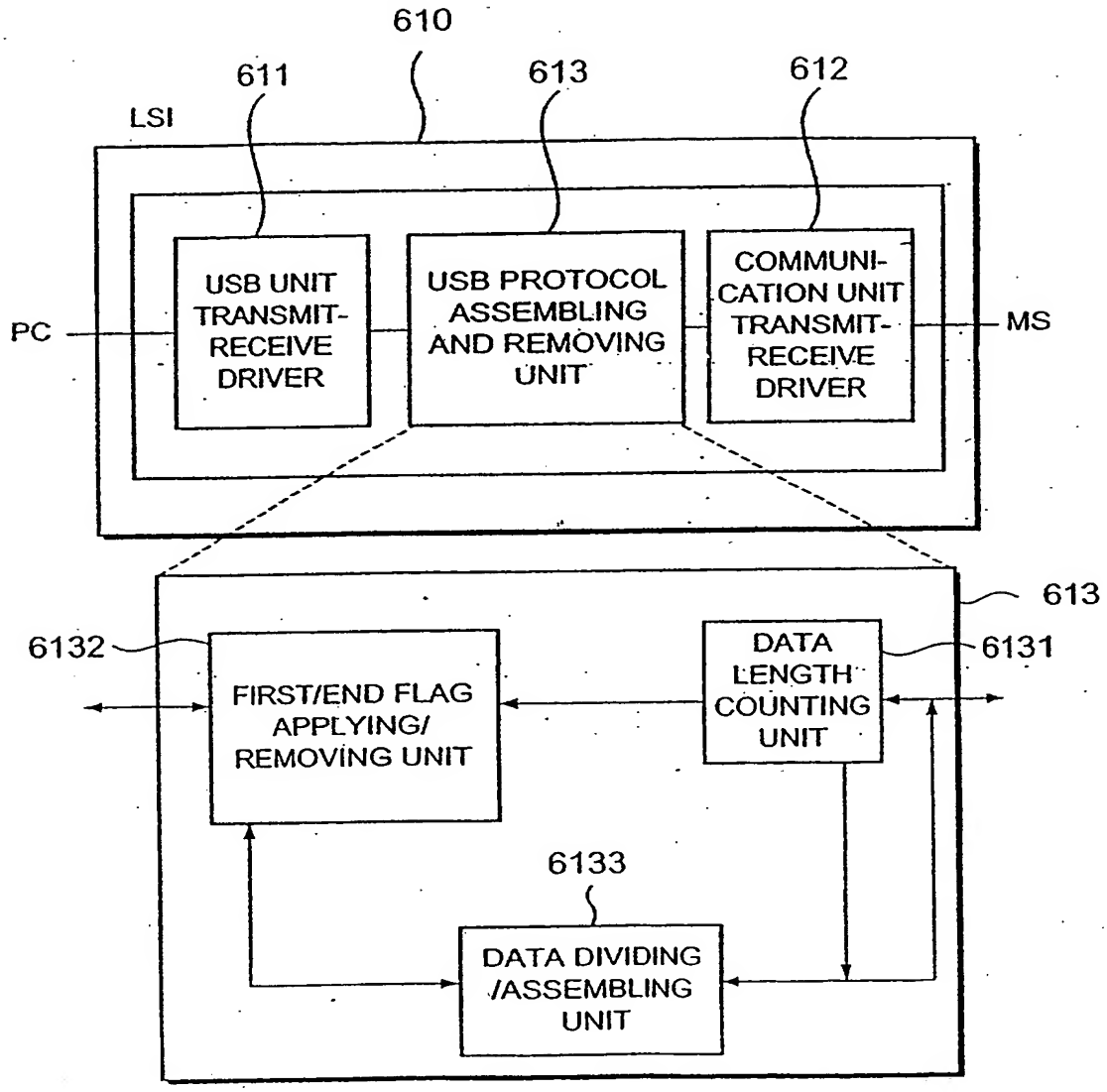

610
611
613
612
LSI
PC
USB UNIT TRANSMIT-RECEIVE DRIVER
USB PROTOCOL ASSEMBLING AND REMOVING UNIT
COMMUNI-CATION UNIT TRANSMIT-RECEIVE DRIVER
MS
613
6132
FIRST/END FLAG APPLYING/ REMOVING UNIT
DATA LENGTH COUNTING UNIT
6131
6133
DATA DIVIDING /ASSEMBLING UNIT

Fig.19

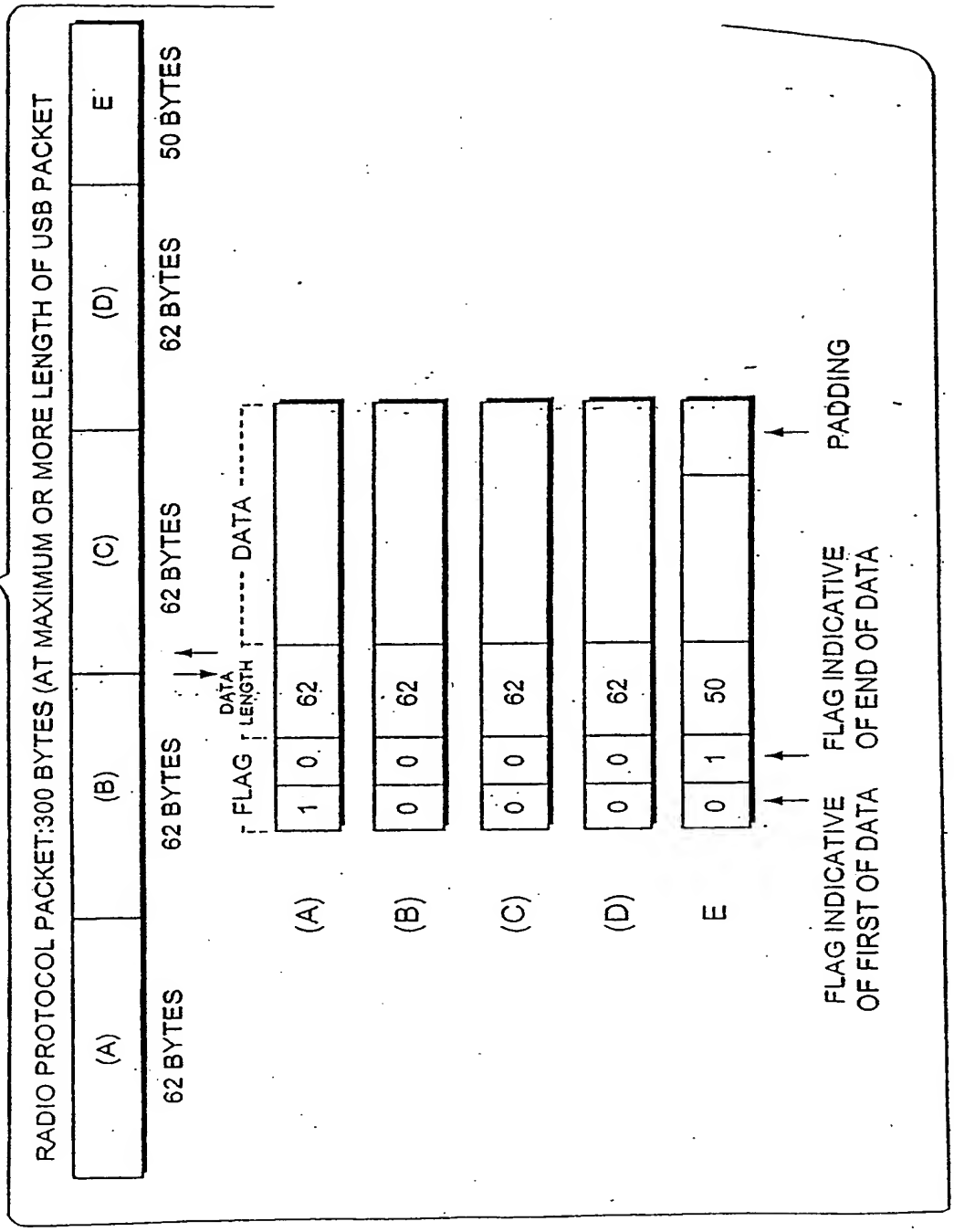

RADIO PROTOCOL PACKET:300 BYTES (AT MAXIMUM OR MORE LENGTH OF USB PACKET
(A)
(B)
(C)
(D)
E
62 BYTES
62 BYTES
62 BYTES
62 BYTES
50 BYTES
FLAG
DATA LENGTH
DATA
(A)
(B)
(C)
(D)
E
1 0 62
0 0 62
0 0 62
0 0 62
0 1 50
FLAG INDICATIVE OF FIRST OF DATA
FLAG INDICATIVE OF END OF DATA
PADDING

Fig.20

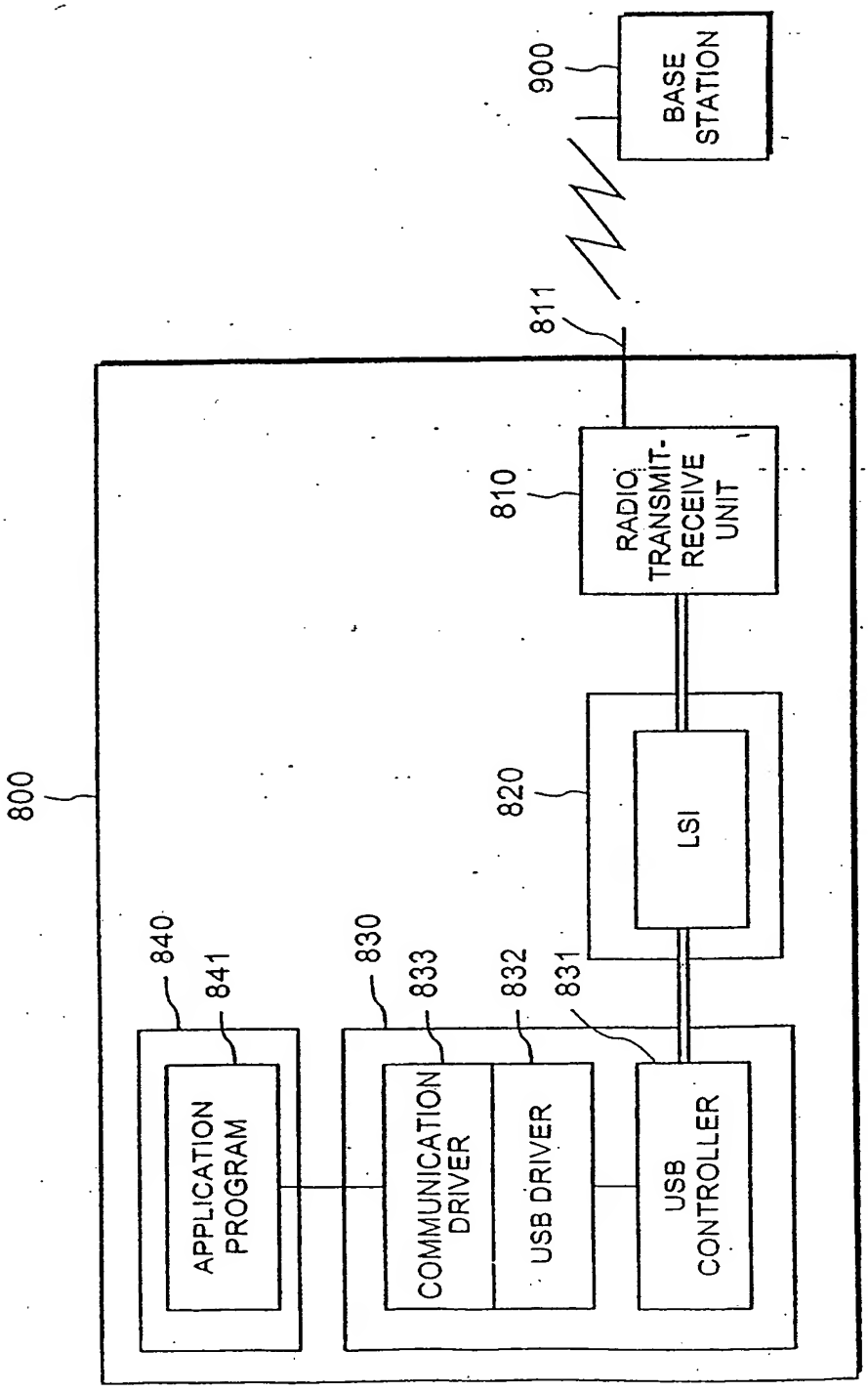
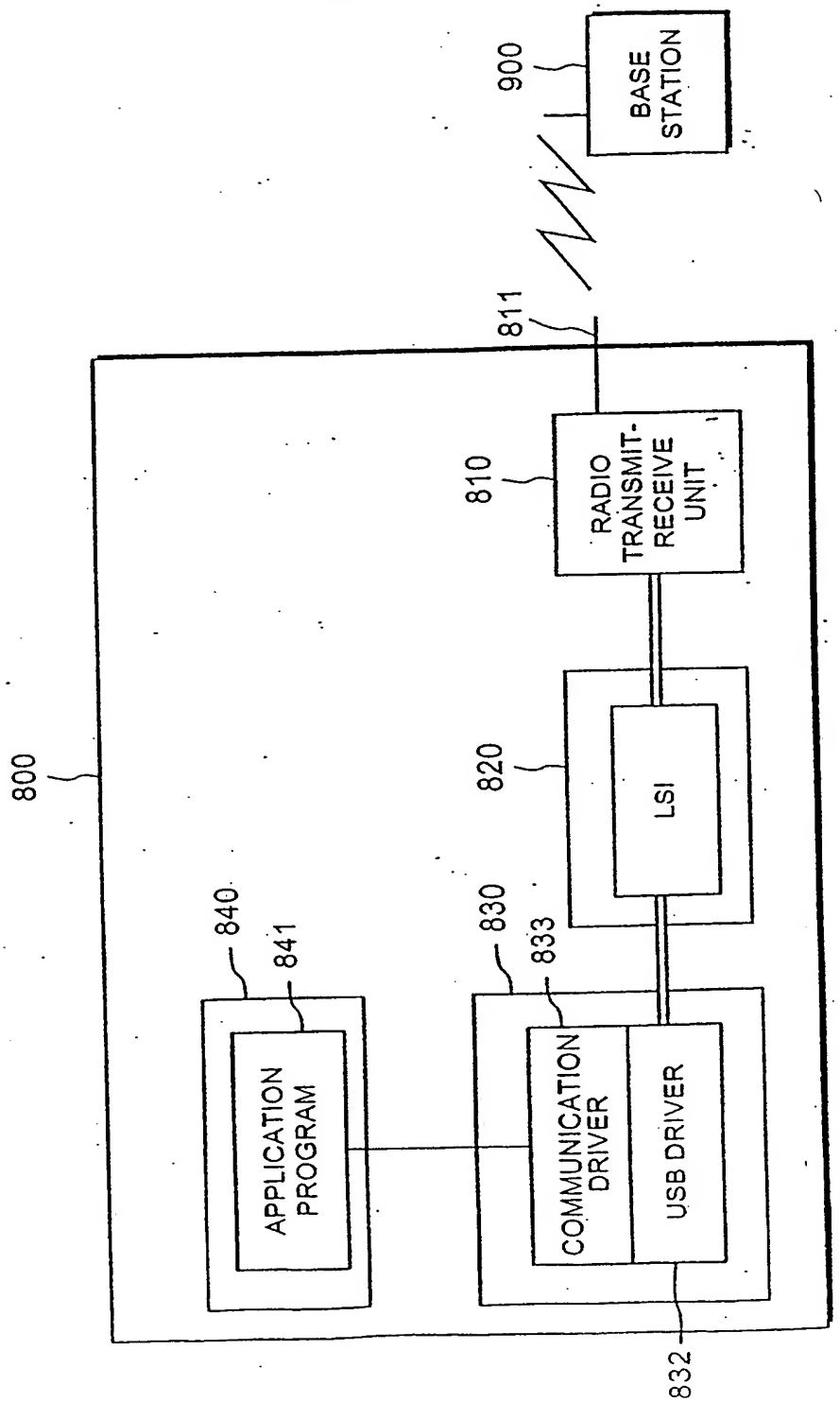

900
BASE STATION
811
810
RADIO TRANSMIT-RECEIVE UNIT
820
LSI
800
840
841
APPLICATION PROGRAM
830
833
COMMUNICATION DRIVER
832
USB DRIVER
831
USB CONTROLLER

Fig.21


900
BASE STATION
811
810
RADIO TRANSMIT-RECEIVE UNIT
820
LSI
800
840
841
APPLICATION PROGRAM
830
833
COMMUNICATION DRIVER
USB DRIVER
832